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## **A macro-ergonomic perspective on analysing and designing knowledge transfer systems in engineering projects within the oil drilling industry**

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### **1. Introduction**

Knowledge from the operations phase of offshore oilrigs is important in other life-cycle phases such as design of new rigs, rig maintenance, and equipment purchasing (Ahmed-Kristensen & Vianello 2014; Conceicao et al. 2012). The feedback of operations knowledge may facilitate correction of flaws and suggest improvements that will support rig workers safety, wellbeing and the overall rig performance. However, it is acknowledged that there are a number of obstacles to set up efficient knowledge transfer processes (Ranjbarfard et al. 2014). Also, the integration of human factors and ergonomics expertise and knowledge into the design of rigs is poor or missing (Johnsen 2014).

In this paper we are illustrating how the field of macro-ergonomics can help to analyze and design systems for knowledge transfer. We base our approach mainly on the notion of work systems as developed by Alter (2006) and his suggestions on co-existence of multiple work systems (Alter 2010). He suggests a work system framework consisting of nine elements, including 'information'. We also include Dixon's notion of 'common knowledge', that is knowledge generated from the experience of people engaged in organizational tasks (Dixon 2000). Common knowledge is derived from action, e.g. rig workers, and it carries the potential for others, e.g. designers of new rigs, to use it to take action.

The aim of the overall study is to analyze existing knowledge transfer, and to develop and test methods and tools for knowledge transfer from the rig operations phase to the onshore design phase of new rigs. In this paper we report results from the analysis phase and based on the results we suggest tools to be used in an intervention aimed at improving the knowledge transfer system.

### **2. Method**

Within an interactive research approach (Eklund et al. 2008) a case study methodology was selected. The case was an international drilling company searching for how to improve the knowledge transfer processes from offshore operations to onshore engineering design projects. In the first phase we conducted an analysis of the current knowledge transfer systems to understand its strengths and weaknesses. In the second phase we will propose tools and methods to overcome some of the weaknesses and improve the knowledge transfer. As part of the analysis in the first phase we defined the offshore-onshore system as being two co-existing work systems that have to coordinate and collaborate, including exchange of knowledge and information.

Data was collected through semi-structured interviews, and studies of company documents. The main interview themes focused on information content and communication media applied in the collaboration between the two work systems. A total of nine interviews were conducted with participants across the two work systems. They included engineering project managers, health and safety system manager, maintenance supervisor, operations performance coach, innovation manager, and drilling superintendent. The interviews were transcribed and analyzed by an inductive methodology (Thomas 2006).

### **3. Results**

The analysis showed that there is a pool of unexploited experiences that is highly relevant for the design and maintenance phase of rigs. Part of this experience pool is captured and transformed into information in company-wide IT systems. However, this information is very difficult to retrieve for the onshore engineering designers and the information content is not formatted for use in an engineering design project. Individuals having a role as boundary spanners between the two systems transfer another part of the experience pool from the offshore to the onshore work system. Including an experienced rig worker in design project teams was an important way of aligning the information and knowledge transfer between the two work systems.

The main challenges is to capture operational experiences onboard the rigs, transform this into valuable, design relevant information and transfer it to the engineering design projects in the onshore work system.

#### 4. Discussion

In aligning the two work systems for optimal information and knowledge transfer we propose to focus on new methods and tools for capturing and transforming operational experience. However, a more detailed analysis of the onshore engineering project work system is needed.

##### *Onshore work system*

It is important to start by identifying what type of rig operations knowledge is relevant in the design phase of new rigs to improve the ergonomic design. We also need to identify what type of knowledge the engineering designers are demanding and value, and in what formats and by which sort of media. Finally, targeted data mining in the current IT systems on operations data might generate valuable information for the design phase that are not visible in today's systems.

##### *Offshore work system.*

In this work system an intention is needed to create knowledge out of experience that is valuable in the design phase of new rigs. This may require setting up new rig procedures for identifying and codifying valuable design knowledge.

The challenge is how to generate knowledge from the daily work experiences, systematize and codify it, and transfer it to the engineering design project members in a format that is valuable for them. We will visit a rig in order to demonstrate how an ergonomist by help of work systems analysis methodology based on observations and contextual interviews (Beyer & Holtzblatt 1998) may help to create this type of knowledge. Checklists and templates will be developed to support transforming observations and interviews into systematized and retrievable information. We will include smartphone to take pictures of spaces and equipment that for some reasons are inadequate, inefficient or risky (Pritchard & Symon 2014). The pictures will be included in the information templates, indexed and stored in an electronic repository available for the engineering designers.

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